

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



Level 2 Certificate in Further Mathematics
June 2013

Further Mathematics

8360/2

Level 2

Paper 2 Calculator

Friday 21 June 2013 9.00 am to 11.00 am

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • a calculator • mathematical instruments. 	
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Time allowed

- 2 hours

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- In all calculations, show clearly how you work out your answer.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 105.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.
- The use of a calculator is expected but calculators with a facility for symbolic algebra must **not** be used.

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22 – 23	
24 – 25	
TOTAL	

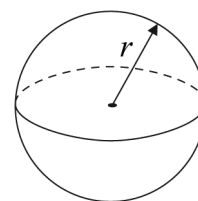


J U N 1 3 8 3 6 0 2 0 1

Formulae Sheet

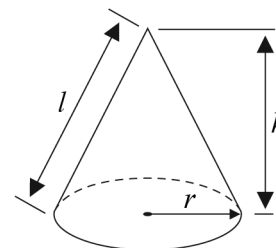
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$



Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$



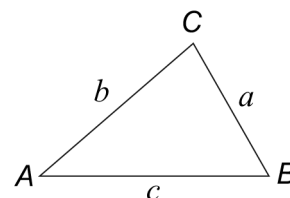
In any triangle ABC

Area of triangle $= \frac{1}{2}ab \sin C$

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

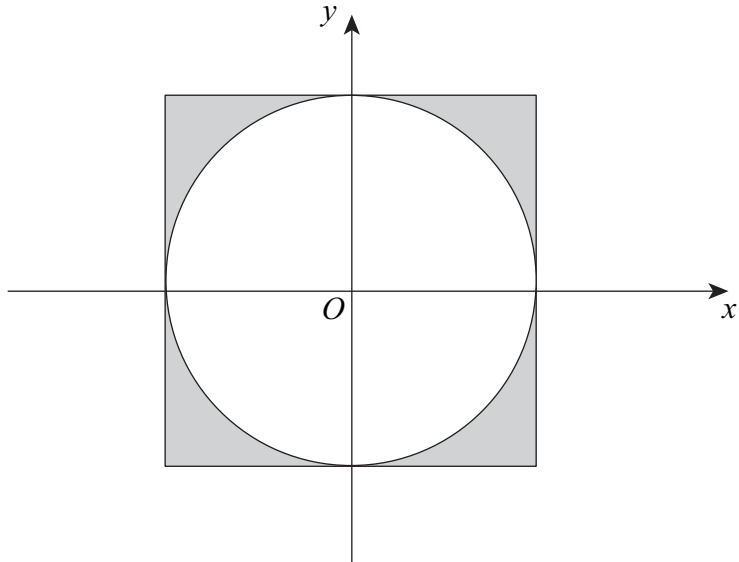
Trigonometric Identities

$$\tan \theta \equiv \frac{\sin \theta}{\cos \theta} \quad \sin^2 \theta + \cos^2 \theta \equiv 1$$



Answer **all** questions in the spaces provided.

- 1 The circle $x^2 + y^2 = 25$ touches each side of the square as shown.



Not drawn
accurately

Work out the total shaded area.

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Answer..... (3 marks)



2 w is an integer such that $6 \leq 3w < 18$
 x is an integer such that $-4 \leq x \leq 3$

2 (a) Work out **all** the possible integer values of w .

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Answer..... (3 marks)

2 (b) Write down the **highest** possible value of x^2

Answer..... (1 mark)

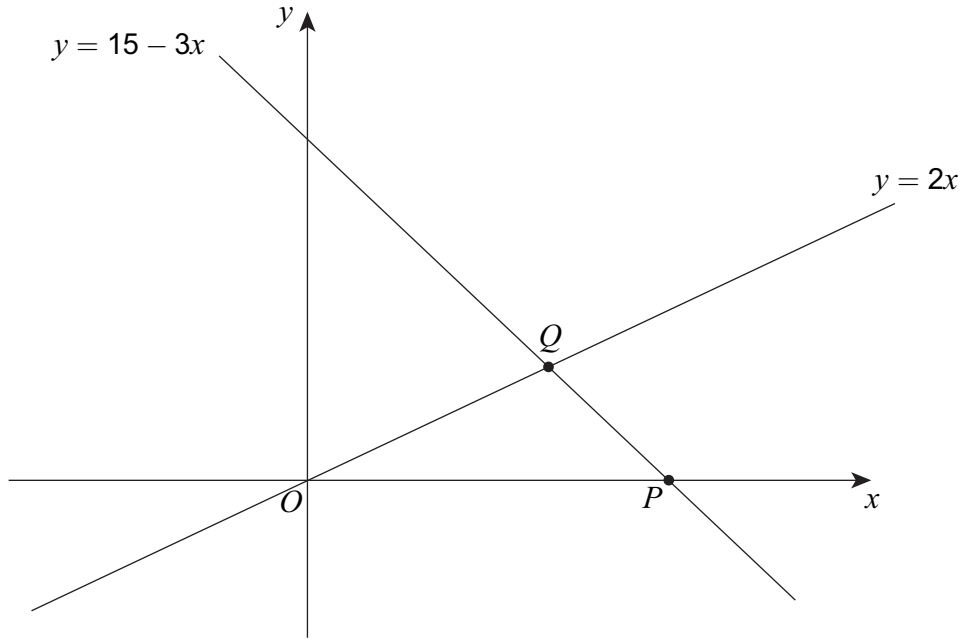
2 (c) Work out the **lowest** possible value of $w - x$

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Answer..... (2 marks)



3 The sketch graphs of two straight lines are shown.



3 (a) Work out the coordinates of P .

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Answer (..... ,) (1 mark)

3 (b) Work out the coordinates of Q .

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Answer (..... ,) (3 marks)

3 (c) Use your answers to parts (a) and (b) to work out the area of triangle OPQ .

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Answer..... (2 marks)

Turn over ►



4 You are given that $m : n = 2 : 5$

4 (a) Write m in terms of n .

$m = \dots\dots\dots$ (1 mark)

4 (b) You are also given that $a : b = 10m : 3n$

Work out $a : b$ where a and b are integers.

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Answer : (2 marks)



5

$$y = (5x - 3)^2$$

Work out $\frac{dy}{dx}$

Give your answer in the form $a(bx - c)$ where a , b and c are integers > 1

$$\frac{dy}{dx} = \dots\dots\dots (4 \text{ marks})$$

Turn over for the next question



6 (a) Show that $\frac{c^2 + 5c + 4}{3c + 3}$ simplifies to $\frac{c + 4}{3}$

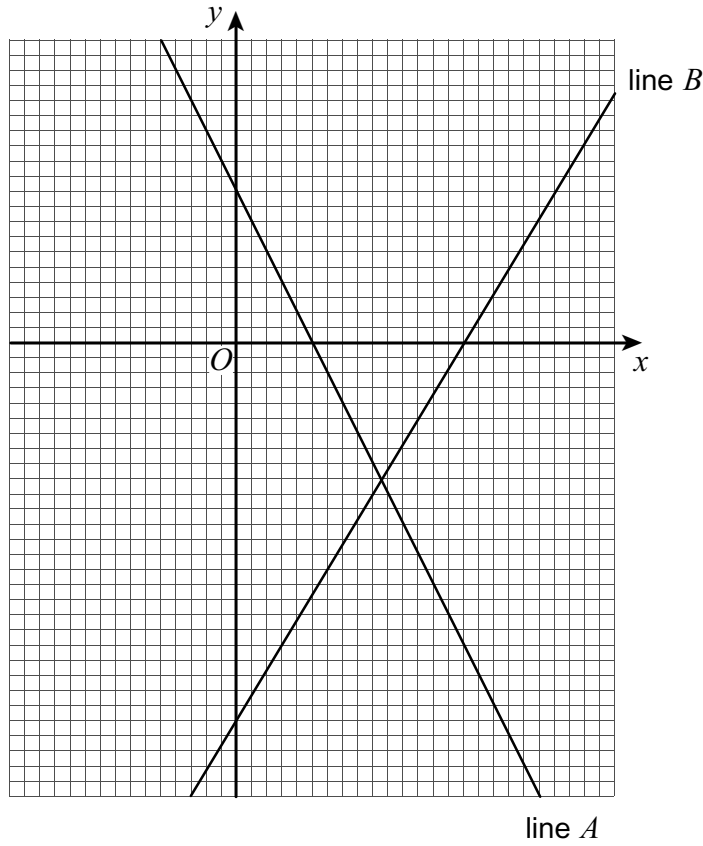
(2 marks)

6 (b) Hence, or otherwise, simplify fully $\frac{c^2 + 5c + 4}{3c + 3} + \frac{3 - 2c}{6}$

Answer..... (3 marks)



7 The graph shows two straight lines.



The equation of line *A* is $y = 2 - x$

Work out the equation of line *B*.

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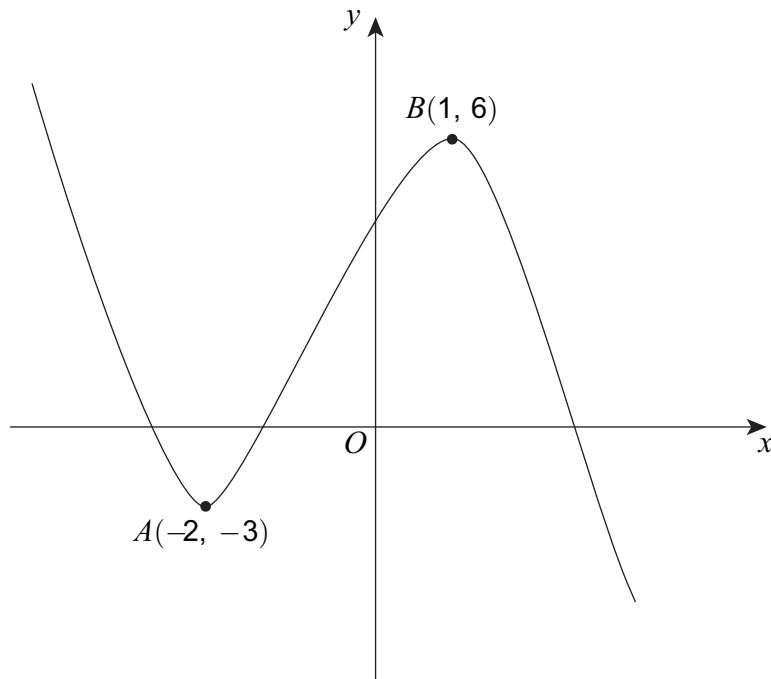
Answer..... (4 marks)

9

Turn over ►



- 8** A sketch of $y = f(x)$ is shown.
There are stationary points at A and B .



- 8 (a)** Write down the equation of the tangent to the curve at A .

Answer..... (1 mark)

- 8 (b)** Write down the equation of the normal to the curve at B .

Answer..... (1 mark)

- 8 (c)** Circle the range of values of x for which $f(x)$ is an increasing function.

$x < -2$ $-2 < x < 1$ $-3 < x < 6$ $x > 1$

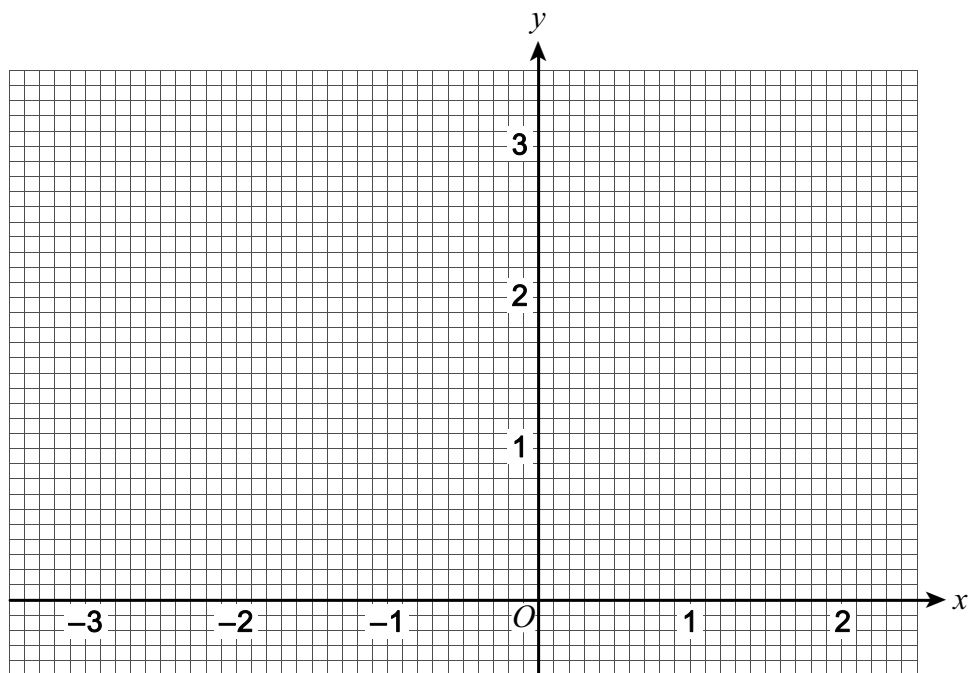
(1 mark)



10 A function $f(x)$ is defined as

$$\begin{aligned} f(x) &= x + 3 & -3 \leq x < 0 \\ &= 3 & 0 \leq x < 1 \\ &= 5 - 2x & 1 \leq x \leq 2 \end{aligned}$$

Draw the graph of $y = f(x)$ for $-3 \leq x \leq 2$



(3 marks)



11 (a) Work out $\begin{pmatrix} 2 & -1 \\ \frac{1}{3} & 0 \end{pmatrix} \begin{pmatrix} 0 & b \\ a & c \end{pmatrix}$

Give your answer in terms of a , b and c .

Answer $\begin{pmatrix} \dots\dots\dots & \dots\dots\dots \\ \dots\dots\dots & \dots\dots\dots \end{pmatrix}$ (2 marks)

11 (b) You are given that $\begin{pmatrix} 2 & -1 \\ \frac{1}{3} & 0 \end{pmatrix} \begin{pmatrix} 0 & b \\ a & c \end{pmatrix} = \mathbf{I}$ where \mathbf{I} is the identity matrix.

Work out the values of a , b and c .

$a = \dots\dots\dots$, $b = \dots\dots\dots$, $c = \dots\dots\dots$ (3 marks)

8

Turn over ►



12 Prove that $(5n + 3)(n - 1) + n(n + 2)$
is a multiple of 3 for all integer values of n .

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(4 marks)

13 The graph of $y = f(x)$ is a straight line.

The domain of $f(x)$ is $1 \leq x \leq 5$

The range of $f(x)$ is $3 \leq f(x) \leq 11$

Work out **one** possible expression for $f(x)$.

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$f(x) =$ (4 marks)



15 (a) $a^{11} \times b^6 \times c = a^9 \times b^{10}$

Write c in terms of a and b .
Give your answer in its simplest form.

$$c = \dots\dots\dots (3 \text{ marks})$$

15 (b) $p^{-2} = q^6 \times r^4$

Write p in terms of q and r .
Give your answer in its simplest form.

$$p = \dots\dots\dots (2 \text{ marks})$$



17 Solve $\frac{4}{x-2} + \frac{1}{x+3} = 5$

Answer..... (7 marks)



18

The curve $y = x^3 + bx + c$ has a stationary point at $(-2, 20)$.

Work out the values of b and c .

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$b =$

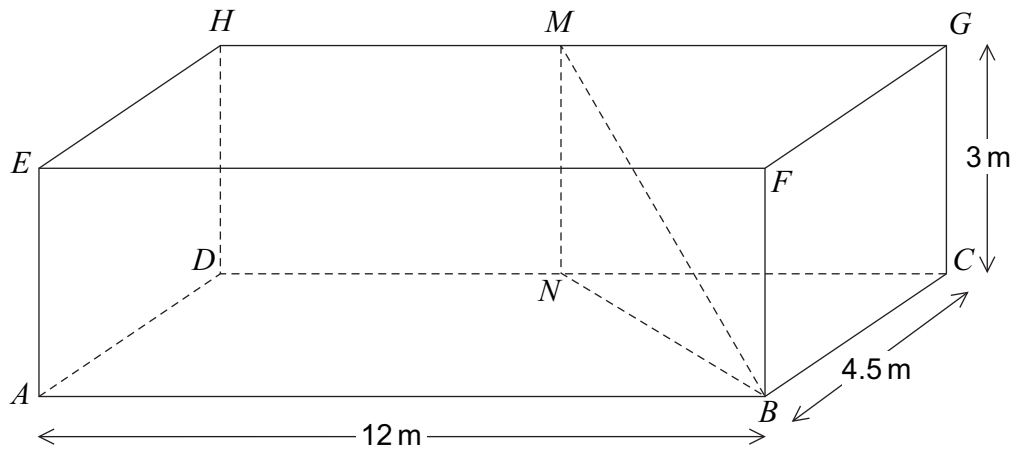
$c =$ (5 marks)

Turn over for the next question



19

$ABCDEFGH$ is a cuboid.
 M is the midpoint of HG .
 N is the midpoint of DC .



19 (a) Show that $BN = 7.5$ m

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(2 marks)



19 (b) Work out the angle between the line MB and the plane $ABCD$.

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Answer degrees (2 marks)

19 (c) Work out the **obtuse** angle between the planes MNB and $CDHG$.

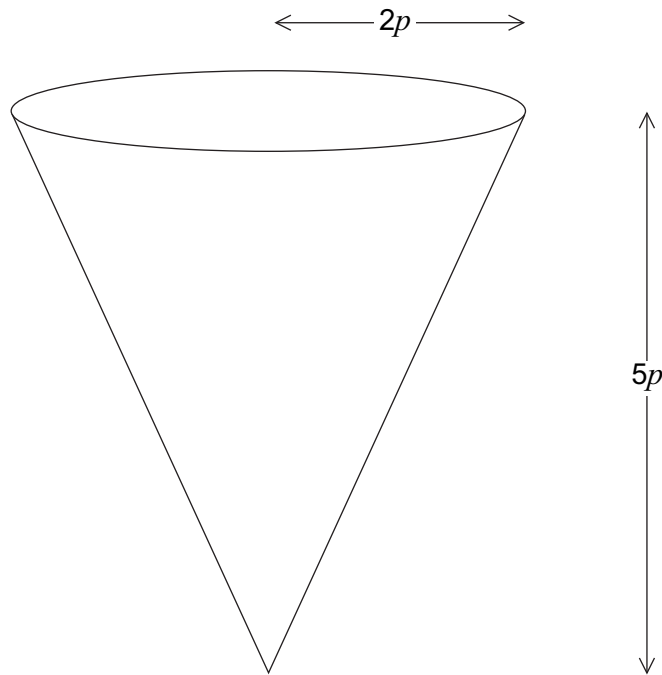
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Answer degrees (2 marks)



20

This right circular cone has radius $2p$ and height $5p$.
The dimensions are in centimetres.



The volume of the cone is $22\,500\pi \text{ cm}^3$.

Work out the value of p .

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$p = \dots\dots\dots \text{ cm (4 marks)}$



21

$(x - a)$ is a factor of $2x^3 - 7ax + 3a$

Work out the **largest** possible value of a .

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Answer..... (4 marks)

22

Solve $\tan^2 \theta + 3 \tan \theta = 0$ for $0^\circ < \theta < 360^\circ$

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Answer..... (5 marks)



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